

## CLAIMS

1. A method of configuring a system using a computer system comprising the steps of:
- 5 defining in said computer system an element model consisting of elements used to configure said system and structural relationships between said elements in said model;
- generating by said computer system a system configuration based on configuration requests and said element model; and
- 10 displaying by said computer system a graphical representation of said system configuration and said structural relationships between said elements of said system configuration.
2. The method of claim 1 such that said configuration requests are
- 15 element requests, resource requests, and needs identifications.
3. The method of claim 1 including the step of generating by said computer system a Bill of Materials report containing a part number and description for each component and spare part in said system configuration,
- 20 resource totals, failed requests, and failed optional requests.
4. The method of claim 1 further including the steps of:
- bundling by said computer system said elements of said system configuration into product groupings; and
- 25 — generating a price quotation for said system configuration.
5. A method of defining a structural model hierarchy in a computer system comprising the steps of:
- defining component, composite, container, port, and connector base
- 30 classes;
- defining derived classes that are derived from said base classes

defining leaf descendants that descend from said base and derived classes;

defining a composite hierarchy substructure such that a first model element that is part of said second model element that is descended from said composite base class is defined to be a "child of" said second model element;

defining a container hierarchy substructure such that a first model element that is contained within a second model element that is descended from said container base class is defined to be "contained by" said second model element; and

defining a port relationship substructure such that a first model element that connects to a second model element that is descended from said port base class is defined to "connect with" said second model element.

6. A method of configuring a system in a computer system comprising the steps of:

— providing a structural model hierarchy comprised of composite and container hierarchies and port relationships substructures;

providing in said computer system a configuration instance;

(a) modifying said configuration instance in response to a request by creating in said configuration instance instances of one or more model elements based on said request;

(b) storing said modifications in a list of modifications;

(c) examining said instances to determine if a constraint exists;

(d) satisfying in said computer said constraint when said constraint exists;

(e) committing said modifications to said configuration instance and removing said modifications from said modifications list when no constraint exists and when said constraint is satisfied; and

(f) removing said modifications from said configuration instance and said modifications list when said constraint is not satisfied.

7. The method of claim 6 wherein said configuration instance is empty when a new configuration is being defined and said configuration instance contains an existing configuration when an existing system is being updated.

8. The method of claim 6 wherein said instances in said configuration are constrained by one or more of said composite and container hierarchies and port relationships.

9. The method of claim 6 further including the steps of satisfying in said computer component constraints of said component hierarchy when said instances are constrained by said component constraints;

satisfying in said computer container constraints of said container hierarchy when said instances are constrained by said container constraints; and

satisfying in said computer connection constraints of said port relationship when said instances are constrained by said connection constraints.

10. The method of claim 6 further including the steps of: identifying an alternative for satisfying said request when said instances of one or more model elements fail to satisfy said request and when said instances of one or more model elements fail to satisfy said constraints; and

repeating steps (a) through (f) for said alternative.

11. The method of claim 6 further including the step of indicating that said request failed when said instances of one or more model elements fail to satisfy said request and when said instances of one or

more model elements fail to satisfy said constraints and no alternative can be identified to satisfy said request.

12. A method of satisfying a resource request in a computer system  
5 for configuring systems comprising the steps of:

providing a structural model hierarchy and a plurality of resources  
offered by elements in said structural model hierarchy;

providing in said computer system a configuration instance;

(a) examining said configuration instance for an element offering a  
10 resource in response to a request for said resource;

(b) selecting said resource from said element when said resource has  
not been previously consumed;

(c) selecting a newly created element instance that offers said resource  
if no existing elements satisfy said resource request; and

15 (d) repeating steps (a) through (d) when said element selection does  
not satisfy query and test conditions.

13. A method of satisfying a container constraint in a computer  
system for configuring systems comprising the steps of:

20 providing a structural model hierarchy comprised of composite and  
container hierarchies and port relationships substructures;

providing in said computer system a configuration instance;

satisfying in said computer said container constraint when said  
container constraint exists by:

25 (a) examining said configuration instance to determine whether a  
container instance is available to satisfy said container constraint;

(b) modifying said configuration instance by creating a new container  
instance when said container constraint cannot be satisfied by a container  
instance in said configuration instance;

(c) storing said modifications in a list of modifications when said container constraint cannot be satisfied by a container instance in said configuration instance;

5 (e) examining said new container instance to determine if a constraint exists;

(f) satisfying in said computer said constraint when said constraint exists on said new container instance;

(g) committing said modifications to said configuration instance and removing said modifications from said modifications list when no  
10 constraint exists and when said constraint is satisfied; and

(h) removing said modifications from said configuration instance and said modifications list when said constraint is not satisfied.

14. A method of satisfying a component constraint in a computer  
15 system for configuring systems comprising the steps of:

providing a structural model hierarchy comprised of composite and container hierarchies and port relationships substructures;

providing in said computer system a configuration instance;

satisfying in said computer said component constraint when said  
20 component constraint exists by:

(a) examining said configuration instance to determine whether a component instance is available to satisfy said component constraint;

(b) modifying said configuration instance by creating a new component instance when said component constraint cannot be satisfied by  
25 a component instance in said configuration instance;

(c) storing said modifications in a list of modifications when said component constraint cannot be satisfied by a component instance in said configuration instance;

(e) examining said new component instance to determine if a  
30 constraint exists;

(f) satisfying in said computer said constraint on said new component instance when said constraint exists;

(g) committing said modifications to said configuration instance and removing said modifications from said modifications list when no  
5 constraint exists on said new component instance and when said constraint is satisfied; and

(h) removing said modifications from said configuration instance and said modifications list when said constraint on said new component instance is not satisfied.

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15. A method of satisfying a connection constraint in a computer system for configuring systems comprising the steps of:

providing a structural model hierarchy comprised of composite and container hierarchies and port relationships substructures;

15 providing in said computer system a configuration instance;

generating a connection constraint such that a target element in said configuration instance requires a connection to a destination element of said configuration instance

(a) generating a list of destination elements;

20 (b) selecting one destination element from said list of destination elements;

(c) identifying unconnected ports of said destination element that are accessible from said target element;

(d) identifying available ports of said target element;

25 (e) selecting a first port from one of said unconnected ports of said destination element;

(f) selecting a second port from one of said available ports of said target element;

30 (g) comparing the physical type and logical datatype of said first port with the physical type and logical datatype of said second port;

(h) examining the transfer path between said first port and said second port;

(i) connecting said first port to said second port when said physical type and logical datatype are compatible and when said transfer path exists  
5 between said first port and said second port; and

(j) repeating steps (b) through (i) when said physical type and logical datatype are not compatible and when said transfer path does not exist between said first port and said second port.

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